Math-in-CTE Lesson Plan Template

| Lesson Title: AT-09- Alignment | | Lesson # 09 | | |
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| Author(s): | Phone Number(s): | E-mail Address(es): | | |
| Steve Christy | | Steve.christy@lakeregionschools.org | | |
| Amanda Hession | | Amanda.hession@lakeregionschools.org | | |
| Occupational Area: Automotive Technician | | | | |
| CTE Concept(s): Analyzing Alignment Information and Required Adjustments | | | | |
| Math Concepts: Plus Minus Sign / Tolerance Range | | | | |
| Lesson Objective: | Students will be able to use alignment machine spec and tolerance information to visualize the range of acceptable value Students will be able to determine if their vehicle readings are within tolerance. Students will be able to determine if correction requires an increase or decrease in measured angle. | | | |
| Supplies Needed: | Alignment Machine and output, Car. | | | |

| THE "7 ELEMENTS" | TEACHER NOTES (& Answer Key) |
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| 1. Introduce the CTE lesson. | |
| The car is on the alignment machine and we need to understand the information the machine is telling us. How do we use this information to assess the alignment of the vehicle and determine the corrections that need to be made? | This lesson should fall within a larger unit covering alignment, towards the end. Specifically following the set up of the vehicle on the alignment machine. Students have learned the theory of angles and their relationship with each other (as they relate to the alignment of the wheels). They have experienced setting up the vehicle on the alignment machine and are ready to interpret the outputs. |
| 2. Assess students' math awareness as it relates to the CTE lesson. | |
| Lets look at the output from the alignment machine. How are we going to interpret this information? Ask for student responses. Leading questions: What does SPEC mean? What does TOL mean? What does ± mean? How will we use this information to make sure the alignment is | Students and instructor should have a copy of alignment machine report to read and interpret during this conversation. |



| done correctly? | SPEC stands for specification. |
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| | TOL stands for tolerance |
| | ± is a plus minus sign. It tells you to add the two numbers and to subtract the second number from the first. |
| | Output from the alignment machine may be different according to the brand you have in your shop. |
| 3. Work through the math example <i>embedded</i> in the CTE lesson. | |
| Let's look at the specification and tolerance information. Example: Spec is 0.7 with a tolerance of \pm 0.3. | Students should be observing the presentation. |
| This is telling us to add (plus) 0.3 to 0.7 to get the high end of the acceptable tolerance. | |
| 0.3 + 0.7 = 1.0 0.3 | Add the TOL value to the SPEC for the upper range value. |
| <u>+ 0.7</u> | |
| 1.0 | |
| The highest acceptable value is 1.0. | |
| This is also telling us to subtract (minus) 0.3 from 0.7 to get the low end of the acceptable tolerance. | Subtract the TOL value from the SPEC for the lower range value. |
| 0.7 - 0.3 = 0.4 0.7 | |
| <u>+ 0.3</u> | |
| 0.4 | |
| The lowest acceptable value is 0.4. | |
| For this vehicle we have an acceptable range of 0.4 to 1.0. | |
| This can be visualized using a number line. | Instructor can help students visualize the acceptable tolerance using the number line and the verbal description. Show that the SPEC |



| WITHIN TOLERANCE | value goes in the middle. | |
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| 0.4 0.7 1.0 Ask students how the live reading relates to the acceptable tolerance. If the live reading is 1.2, where does that value relate to our acceptable tolerance? | Offer students several possible live readings and have them place | |
| If the live reading is above the acceptable tolerance we need to decrease the angle. If the live reading is below the acceptable tolerance we need to increase the angle. | below spec. Question and reinforce that depending on where the live reading falls you will have to decide to increase or decrease the measured angle. [The actual value you will increase or decrease the angle depends on many factors outside of just the number.] | |
| 4. Work through <i>related, contextual</i> math-in-CTE examples. | | |
| Have a vehicle on the machine and allow the students to see the given spec and tolerance information. Ask students to draw the number line that shows the information given. | During this time the students will write down a number line showing the spec and tolerance range. Then place the given live reading in the appropriate place on the number line. | |
| Show students the live reading for the vehicle and ask them to place the value on the number line. Then determine if that value falls within, above or below tolerance. Ask students to state what they would do in response to the live reading. | Have students with paper and pencils so they can draw the number line for the camber, caster and toe specifications and tolerances. Remind students to add the tolerance, and subtract the tolerance to | |
| Adjust the vehicle to provide a different live reading. Students should place the new value on their number line and determine if the value is acceptable, above or below. | get the range of acceptable values. | |
| Repeat this procedure for the camber, caster and toe readings, adjusting the live readings to provide multiple opportunities for students to create a number line, show the tolerance range, place values on the number line and state the appropriate response to the live reading (increase, decrease or keep the angle the same) | Instruct students to place the live reading value on the appropriate number line as new readings are generated. Discuss with students what they would do in response to the live reading | |
| Additional examples can be created using engine performance specs, machine tolerance specs, etc. | | |



| 5. Work through <i>traditional math</i> examples. | |
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| Use the worksheet AT_09_Alignment_WS | |
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| 6. Students demonstrate their understanding. | |
| During the next few course days students will practice and build on this skill as they learn to interpret the information the car is telling them (tire wear, user needs, etc.). Students will practice and continue to demonstrate their understanding by appropriately indicating a tolerance range, determining if a live reading is within or outside of tolerance and then determining the appropriate correction for live readings outside of tolerance on a vehicle. | Remember to use plus (addition) and minus (subtraction) to reinforce how to set up the range. Explain that students will begin to visualize the number line and tolerance range in their head as they continue to practice. |
| 7. Formal assessment. | |
| Student will (individually) set up the vehicle on the alignment machine, get a printout and perform the necessary corrections. The vehicle is then driven and if it goes straight = success. | |

NOTES:

